Results of a Pilot Monitoring Project for Topeka Shiners in Southwestern Minnesota: Year Two

submitted to:

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ABSTRACT

This work represents the continuation of a long-term surveying project (Ceas & Anderson, 2004) to conduct baseline presence/absence surveys for Topeka shiners within the federally proposed critical habitat in Minnesota. These data will comprise the second year of an ongoing population-monitoring project designed to provide the DNR with a tool for detecting changes in the overall presence/absence of Topeka shiners within Minnesota.

Twenty random stream segments within the Rock and Big Sioux watersheds of southwestern Minnesota (Missouri River system) were selected using an ArcView extension program. By chance one of these stream segments was a resurvey a 2004 stream segment. Based on known habitat preferences, aerial photos of the twenty stream segments were reviewed to identify the 10 most likely sampling sites within each stream segment. If off-channel habitats were present then these were always included as potential sample sites. A brief field reconnaissance of each stream segment allowed us to rank the ten sites within each segment according to which sites appeared most suitable for Topeka shiners, and sampling was conducted using a 10' x 5' eighth-inch mesh minnow seine.

Topeka shiners were found at sixteen of the twenty 1-mile stream segments, and in ten of these sixteen stream segments Topeka shiners were found at the first site sampled. Few true off-channel habitats existed within the twenty 1-mile stream corridors, and the shiners were generally found in well-developed in-channel pools or backwaters that appear to stay connected to the stream year-round.

The scope of this project was limited and designed to conduct only straightforward presence/absence surveys for Topeka shiners chosen stream segments. Even so, a few of observations were noted. These observations are essentially the same as witnessed during the 2004 sampling: (a) The stream segments that did not produce Topeka shiners were all small headwaters with narrow down-cut channels and almost continuous raceways/flowing waters, and the few off-channel pools were artificial farm ponds that appeared to have steeply-sloped banks; (b) A few of the 1-mile segments had good numbers of individuals and what appeared to be an abundance of suitable habitat, and may warrant a closer look for future habitat enhancement/landowner involvement projects; and (3) the GIS cover of critical habitat/stream channels needs to be updated using current aerial imagery to account for changes in stream position due to the ever-changing stream channels.

INTRODUCTION

This work represents the second year of a long-term surveying project (Ceas & Anderson, 2004) to conduct baseline presence/absence surveys for Topeka shiners within the federally proposed critical habitat in Minnesota (authors' note: Y. C. Anderson is now Y. A. Monstad). As summarized by Ceas & Anderson (2004), recent studies have shown that the Topeka shiner was once a common, wide-ranging species in the small prairie streams of portions of Minnesota, South Dakota, Nebraska, Kansas, Missouri, and Iowa. The species has experienced a widespread decline throughout its historic range, and was listed by the U.S. Fish and Wildlife Service (USFWS) as endangered, effective January 14, 1999.

The consensus among Topeka shiner researchers is that the species is not nearly as abundant in Minnesota (or elsewhere) as it was prior to European settlement and the subsequent alteration of the prairie ecosystem. However, recent surveys of Minnesota waters have shown that the Topeka shiner is "far more common in [this state] than was once thought" (Hatch, 2001). As stated in Tabor (2002), while much habitat in these Minnesota streams has been altered by channelization, erosion, and sedimentation, "current [Minnesota] habitat conditions provide most or all of the primary constituent elements consistent with designation as critical habitat." Topeka shiners appear to exist in disjunct populations that are subject to local extirpation, but recolonization events do seem to occur if a source population is near. Therefore, all streams and associated off-channel pools within the Rock and Big Sioux watersheds of southwestern Minnesota have been proposed as critical habitat.

These data will comprise the second year of an ongoing population-monitoring project designed to provide the DNR with a tool for detecting changes in the overall presence/absence of Topeka shiners within Minnesota. The data obtained during this second year's fieldwork will also be used to conduct a power analysis for evaluating whether or not the sample size of 20 stream segments is adequate for detecting an acceptable level of change in the population's presence/absence. (R. Baker, pers. comm.).

Identification and life history characteristics of the Topeka shiner can be found in many recent reports (e.g., Tabor, 1998; Dahle, 2001; Berg et al., 2004) and will not be repeated here. As noted in Ceas & Anderson (2004), the habitat in which Topeka shiners are almost always found include (1) off-channel habitats (ponds and oxbows/meander cut-off channels) that occasionally get inundated by high water levels from associated streams, and (2) in-channel pools and backwaters that have little to no flow; this species does not normally live in riffles, raceways, or other constantly-flowing waters (Dahle, 2001).

METHODS

Methods followed Ceas & Anderson (2004), and are reproduced with updated information below.

Selection of Stream Segments

Twenty random stream segments (Appendix A) within the Rock and Big Sioux watersheds of southwestern Minnesota were selected using an ArcView extension program written by Tim Loesch (Minnesota DNR). A brief description of this extension file follows (T. Loesch, pers. comm.):

> The extension randomly selects stream segments of user-specified size (one mile lengths in this case). Each line segment that represents a river or stream has a unique value assigned to it that represents the record number in the database for that stream segment. The program doesn't actually pick random points; instead it picks random record numbers that relate to stream segments. The program randomly selects segments by using a random number that is generated between 0 and the number of records in the database (e.g., if the random number is 2014 then the line segment that is record number 2014 in the database is chosen). If that segment is longer than the required length then the middle of the segment is selected and 1/2 of the segment distance is measured out from there and the line is clipped at those positions. If the line is not longer than the desired line length, then the lines that connect to the line are merged together. If that segment is long enough then it will select the center of the line and generate a line that is the correct length.

Landowner Contact

Permission from landowners was required to access the property containing the selected random stream segments. Landowner contact information was determined using plat maps and/or contacting the County Auditor's Office. We contacted landowners by phone before the survey. We explained the purpose and procedure of the survey, and requested permission to come onto their property. If permission was not granted or landowners were not available, the portion of the stream segment outside of the property in question was surveyed. In the latter cases (which were few), Topeka shiners were found in the sampling sites outside of the property; so further sampling within the stream segment was not required.

Selection and Reconnaissance of Sampling Sites

Based on known habitat preferences, we reviewed aerial photos (U.S. Department of Agriculture, Farm Services Agency, Aerial Photography Field Office, Summer 2003, FSA NAIP 2003) of the 20 stream segments to identify the 10 most likely sampling sites within each stream segment. If off-channel habitats (OCH) were present then these were always included as potential sample sites. We then conducted a brief reconnaissance of each stream segment, and ranked the ten sites within each segment according to which sites appeared most suitable for Topeka shiners. Reconnaissance of the streams and sampling for fishes occurred during June 1-2 (Segments 21-31) and June 22-23 (Segments 32-40) 2005. GPS coordinates were taken at each sampling site using a Garmin GPSmap 76.

Sampling for Fishes

Table 1 (Appendix B) lists the twenty stream segments, and provides locality information & basic habitat descriptions of all sampling sites. For each of the 20 stream segments, we began

sampling at the site deemed most likely to contain Topeka shiners. Sampling techniques included standard seine hauls, set-kicks, and "working" undercut banks and vegetated shorelines while using a 10' x 5' eighth-inch mesh minnow seine.

Given the differences in stream sizes and habitat heterogeneity, no attempt was made to standardize sampling effort or time between the sampling sites (quantitative sampling was not a goal of this project). At the sites where Topeka shiners were not found, sampling time varied from 5 minutes (e.g., a simple unobstructed 10-foot long pool) to 30 minutes. All available habitats within a given site were thoroughly sampled until either (1) Topeka shiners were found or (2) in the professional judgment of P. Ceas it was determined that there were no Topeka shiners present. Some additional exploratory sampling took place at a few sites that appeared to contain relatively large numbers of shiners and/or "good" habitat.

RESULTS

Topeka shiners were found at sixteen of the twenty 1-mile stream segments (Table 1, Appendix B; Appendices A & C); they were not found in Segments 21, 25, 31, and 33. In 10 of the 16 stream segments that did contain Topeka shiners, we found the species in the first site sampled (e.g., Site 22-1). These 10 segments & corresponding sites are 22-1, 24-1 26-1, 27-1, 29-1, 30-1, 32-1, 34-1, 35-1, and 37-1. We captured Topeka shiners in the 1st seine haul in seven of these 10 segments; in the 2nd haul at Sites 24-1 and 26-1; and in the 3rd haul at Site 32-1. Topeka shiners were also found in Sites 23-2 (1st haul), 28-3, 36-3, 38-5, 39-2, and 40-9.

Only three of the twenty stream segments (21, 25, 35) contained off-channel habitats, and of these three segments only Site 35-1 (a large oxbow) contained Topeka shiners. The off-channel habitats in Segments 21 and 25 were artificially constructed, relatively steep-sloped ponds that contained tremendous numbers of fathead minnows and black bullheads.

All four of the stream segments in which Topeka shiners were not found (21, 25, 31, 33) had similar stream morphometry in that they were narrow, down-cut, and relatively fast-flowing streams that did not have the typical habitat associated with Topeka shiners. At first glance there did appear to be a few pools scattered among these segments, but with the exception of one large pool in Segment 31, even these pools would almost be better classified as gently flowing runs.

Fourteen of the sixteen stream segments in which Topeka shiners were found contained either (a) a "Topeka-friendly" off-channel habitat, (b) in-stream pools, and/or (c) well-connected backwaters. Site 35-1 (= Segment 7-1 from 2004) was a large connected oxbow that appears to become isolated as the summer water levels recede. Segment 40 was essentially a flowing stream through its entire length, but we did capture one male Topeka shiner in full breeding condition along some riprap near the bridge. The remaining fourteen stream segments contained either main-channel pools or well-developed backwaters that were connected to the main channel.

DISCUSSION

The scope of the second year of this pilot study was to continue to conduct straightforward presence/absence surveys for Topeka shiners in a randomly chosen group of 20 one-mile stream segments. Given the random choosing of stream segments, the streams varied in size and variety of habitats. Therefore, no attempt was made to quantify habitat assessment or sampling effort & time between sites. Even so, we did make a few of observations that seem worthwhile to include in this report, and to compare with results from the 2004 surveys.

(a) As with 2004, the stream segments that did not produce Topeka shiners (21, 25, 31, and 33) were almost continuous raceways/flowing waters. Given the species' preference for pools and slow-moving waters, we were not surprised that Topeka shiners were not found. Although these stream segments do not "appear" to contain habitat that is generally considered typical for Topeka shiners, it would be premature to conclude that Topeka shiners are not found here. It may simply be necessary to sample more than 10 sites within these particular stream segments to be successful in capturing Topeka shiners.

(b) A few of the 1-mile segments had large numbers of individuals (including breeding individuals) and what appeared to be an abundance of suitable habitat. These sites, along with the sites mentioned in Ceas & Anderson (2004), may warrant a closer look for future habitat enhancement/landowner involvement projects. These segments include numbers 22, 23, 24, 27, 30, 32, 35, and 37. Segment 35 is the same as Segment 7 from 2004; we still concur with our 2004 observations that this stream segment may be warrant a closer look for habitat improvement/landowner involvement.

(c) As one can see from the red-dashed lines representing the "federally-proposed designated critical habitat for the Topeka Shiner" on the 2003 aerial photographs (Appendix A) of the stream segments sampled in this study, the GIS cover of some of the critical habitat/stream channels needs to be updated using current aerial imagery.

LITERATURE CITED

Berg, J. A., T. A. Petersen, Y. Anderson, and R. Baker. 2004. Hydrogeology of the Rock River watershed, Minnesota and associated off-channel habitats of the Topeka shiner. Minnesota Department of Natural Resources Report. 13 pp.

Ceas, P. A., and Y. C. Anderson. 2004. Results of a pilot monitoring project for Topeka shiners in southwestern Minnesota. Minnesota Department of Natural Resources Report. 56 pp.

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Hatch, J. T. 2001. What we know about Minnesota's first endangered fish species: the Topeka shiner. Journal of the Minnesota Academy of Science. 65:39-46.

Tabor, V. M. 1998. Final rule to list the Topeka shiner as endangered. Federal Register. 63:69008-69021.

Tabor, V. M. 2002. Endangered and Threatened Wildlife and Plants; Designation of critical habitat for the Topeka shiner. Federal Register. 67:54261-54306

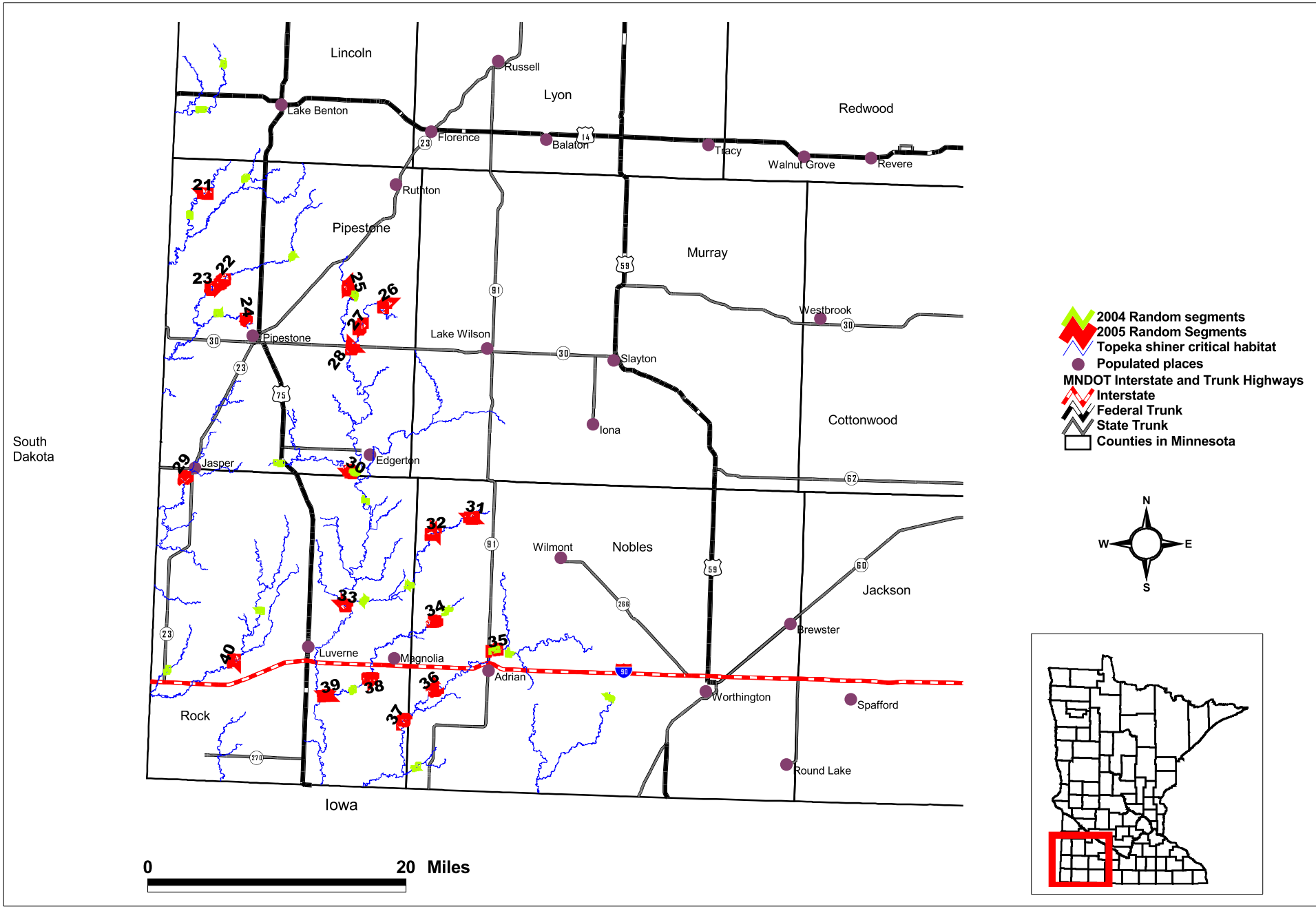
APPENDIX A – MAPS OF STREAM SEGMENTS

The red dots mark the beginning and end points for a given 1-mile stream segment.

The yellow dots (with white numbers) correspond to the Sites given in Table 1, Appendix B.

The red-dotted lines show the actual stream channel as currently defined in the Federally proposed critical habitat shapefile.

Overview of Segments 2005

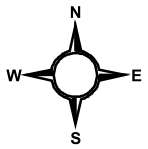


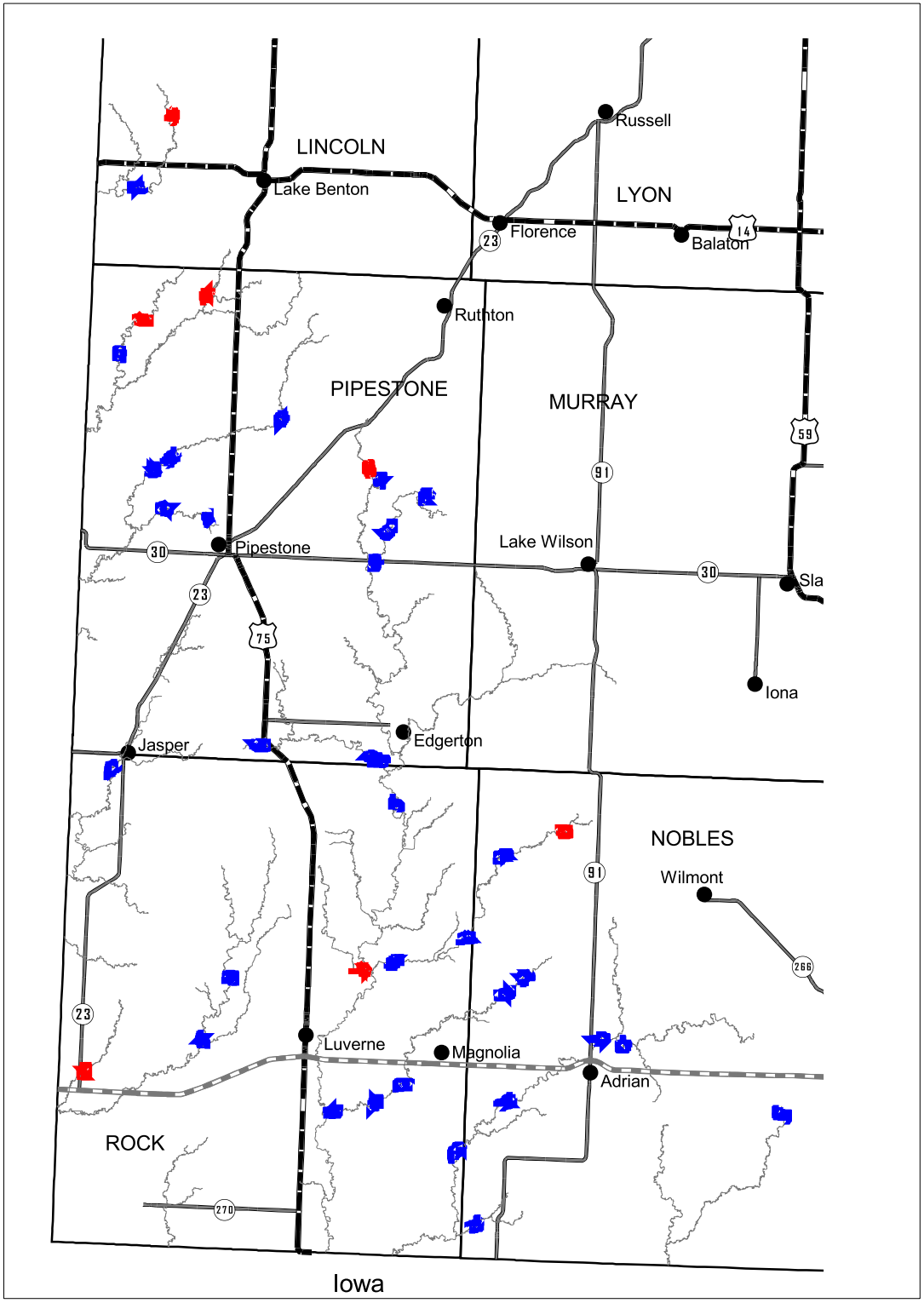
Overview of Segments where Topekas were found 2004-2005

Segments sampled 2004-2005
- Topekas found (n = 33)
- Topekas not found (n = 7)
- Topeka shiner critical habitat
- Populated places

MNDOT Interstate and Trunk Highways
- Interstate
- Federal Trunk
- State Trunk

Counties in Minnesota





Segment 21

Pipestone County

Segment 22

Pipestone County

Segment 23

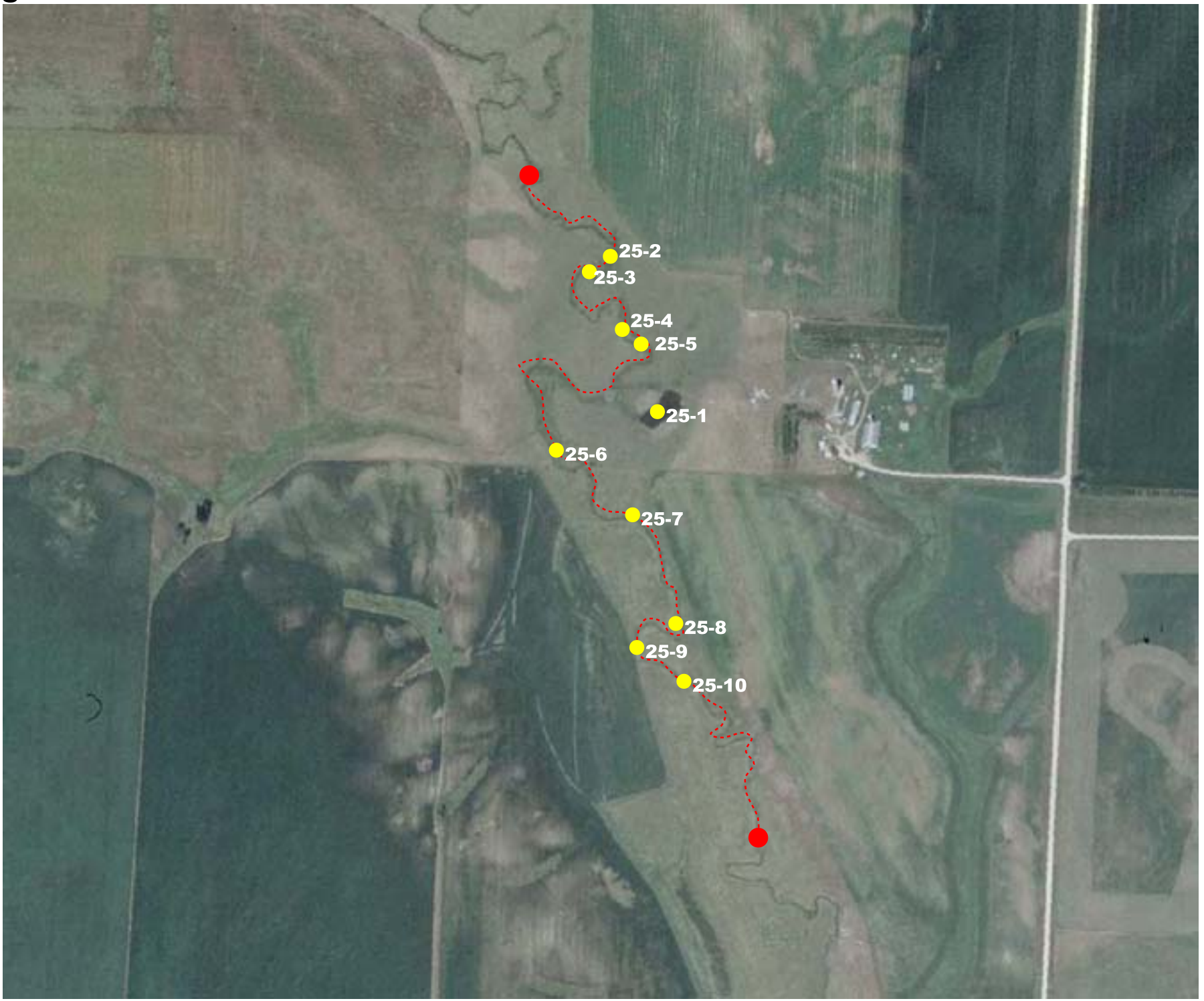
Pipestone County

Segment 24

Pipestone County

Segment 25

Pipestone County



Segment 26

Pipestone County

Segment 27

Pipestone County

Segment 28

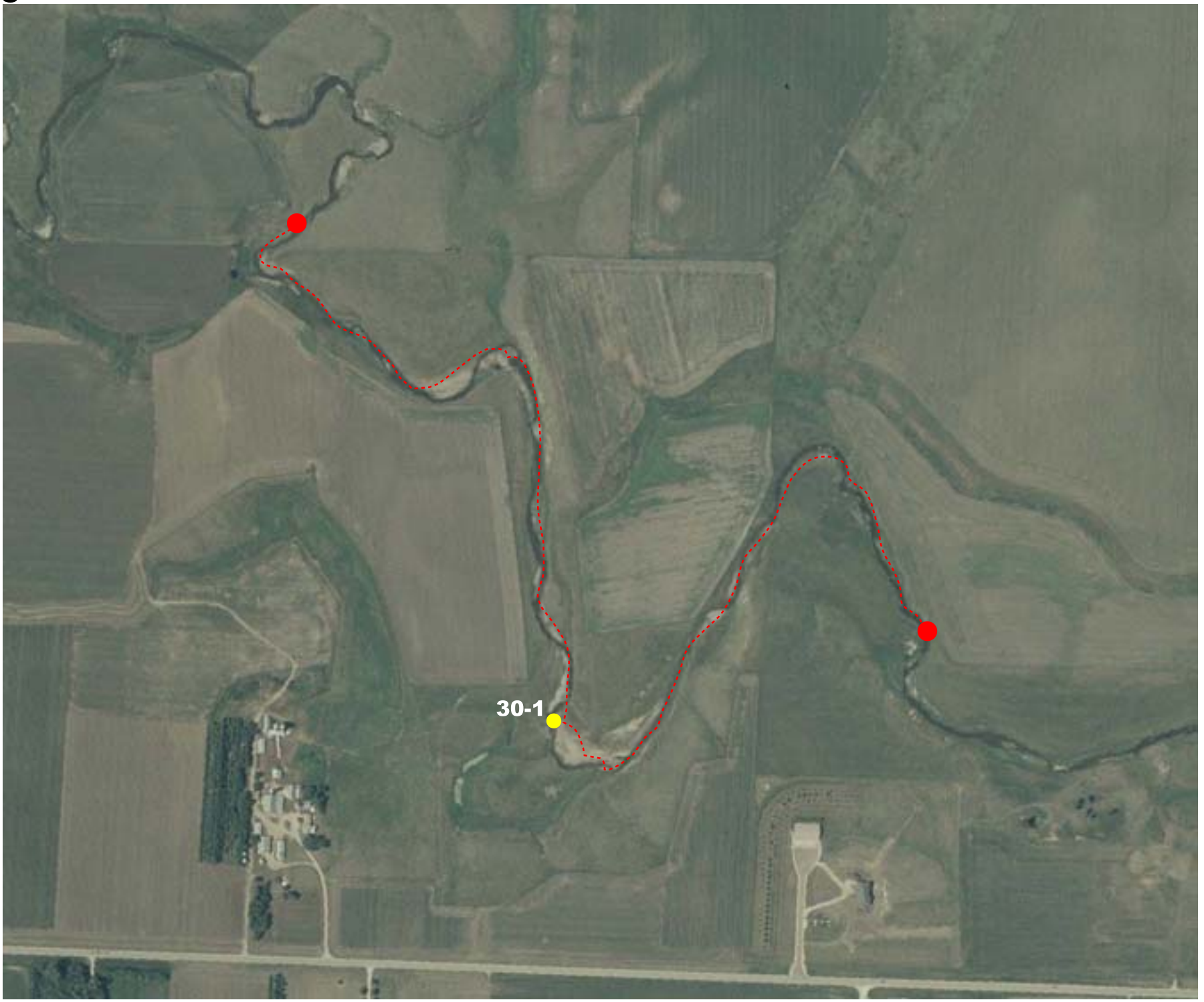
Pipestone County

Segment 29

Rock County

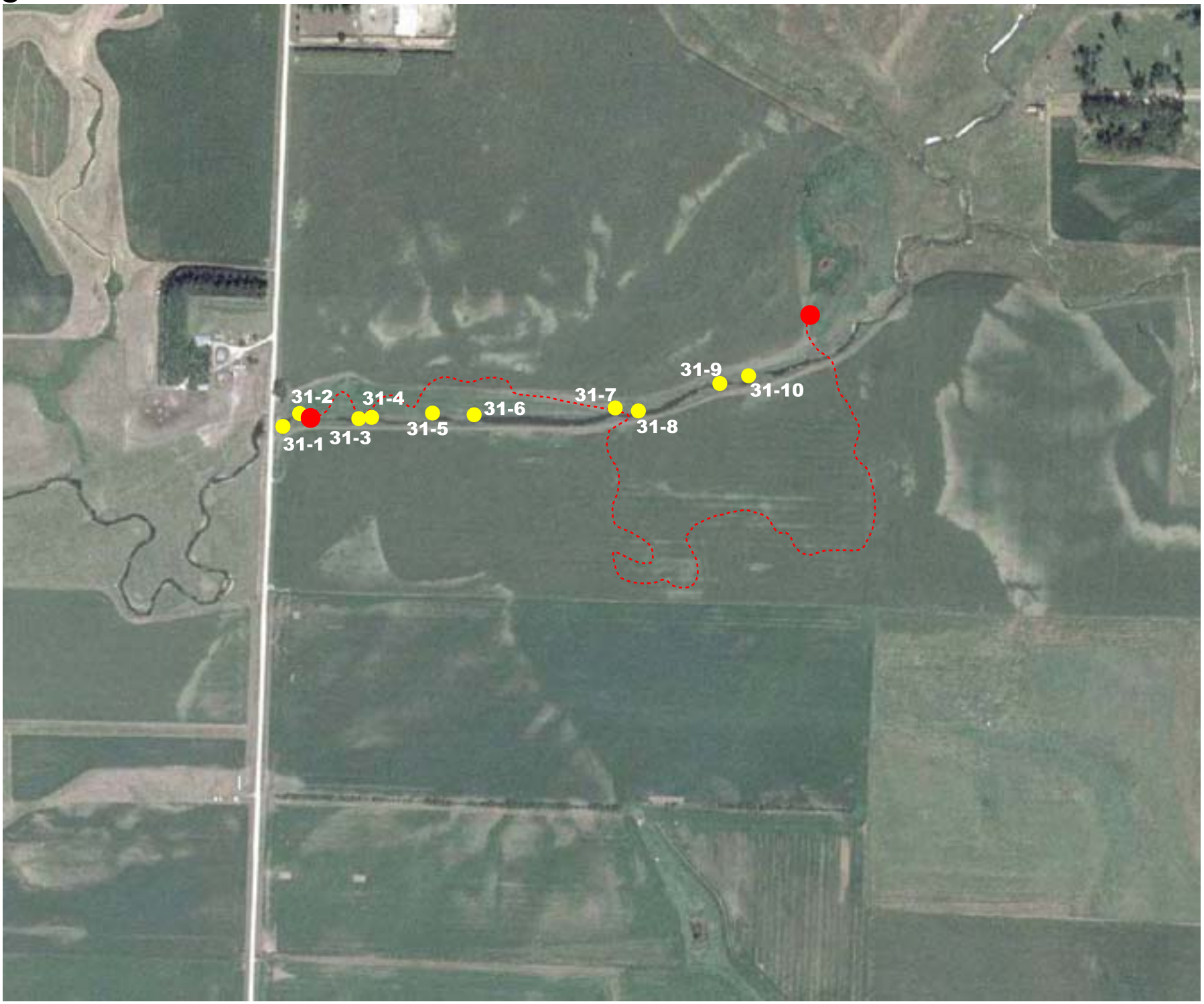
Segment 30

Pipestone County



Segment 31

Nobles County

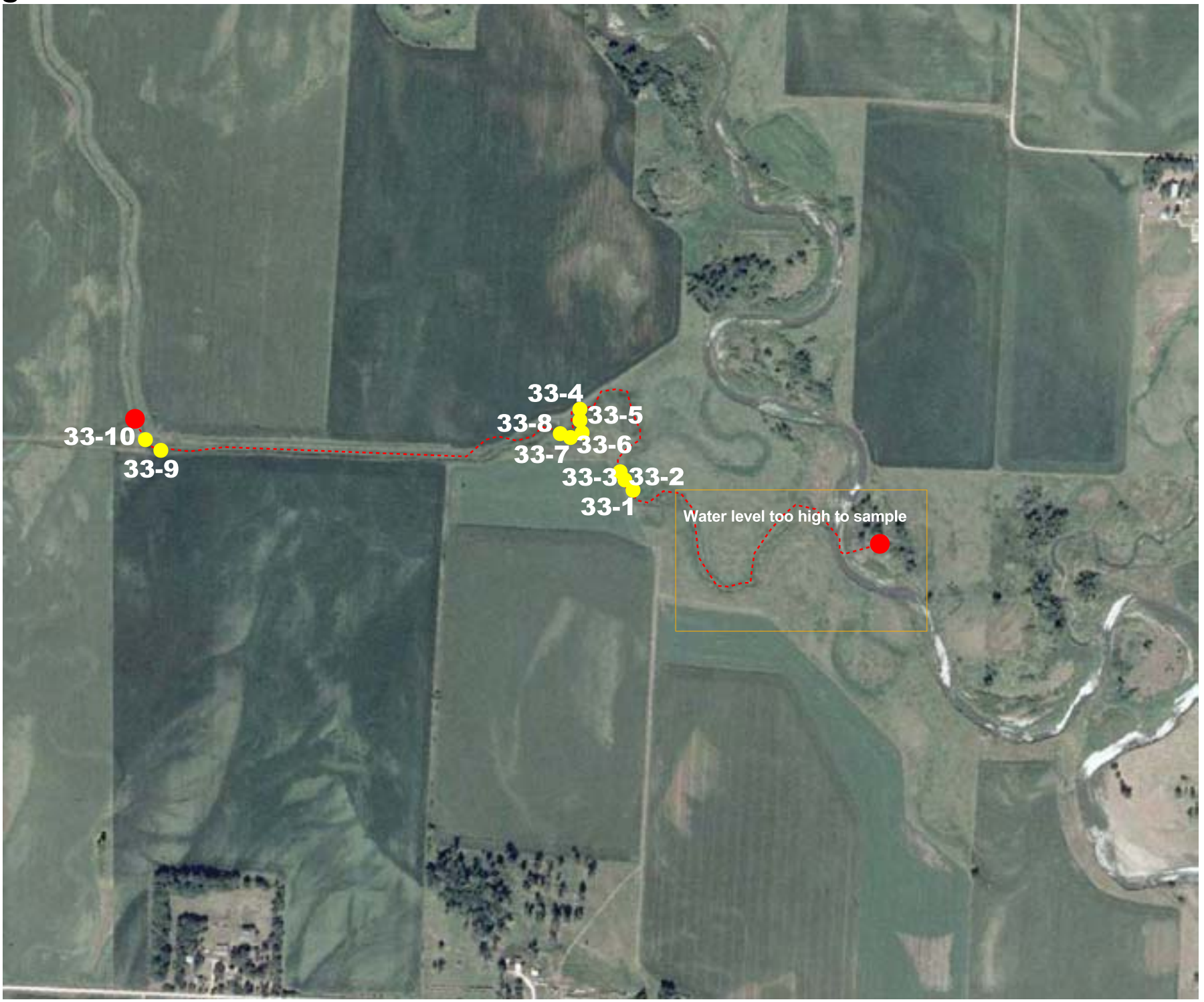


Segment 32

Nobles County

Segment 33

Rock County



Segment 34

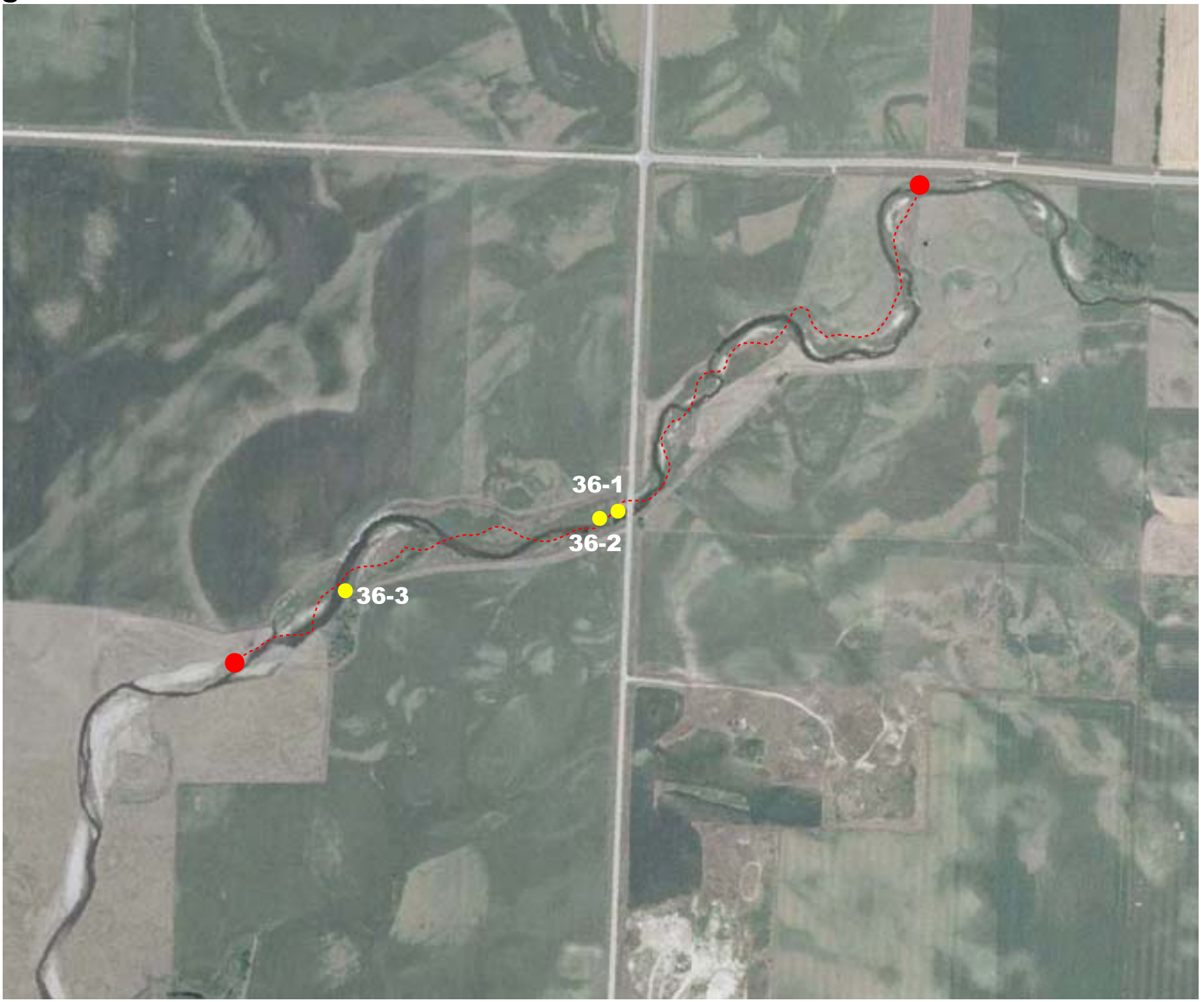
Nobles County

Segment 35

Nobles County

Segment 36

Nobles County

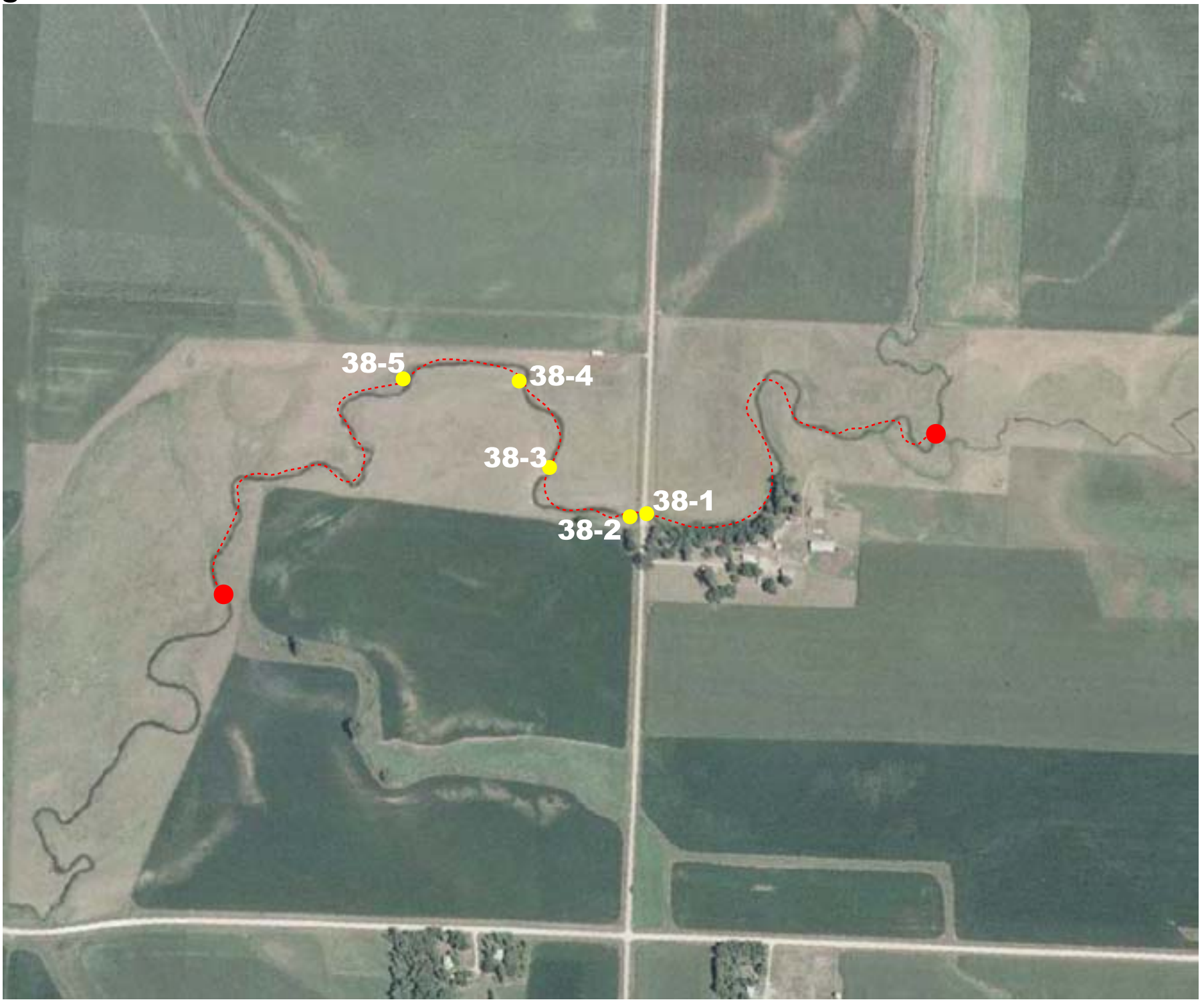


Segment 37

Rock County

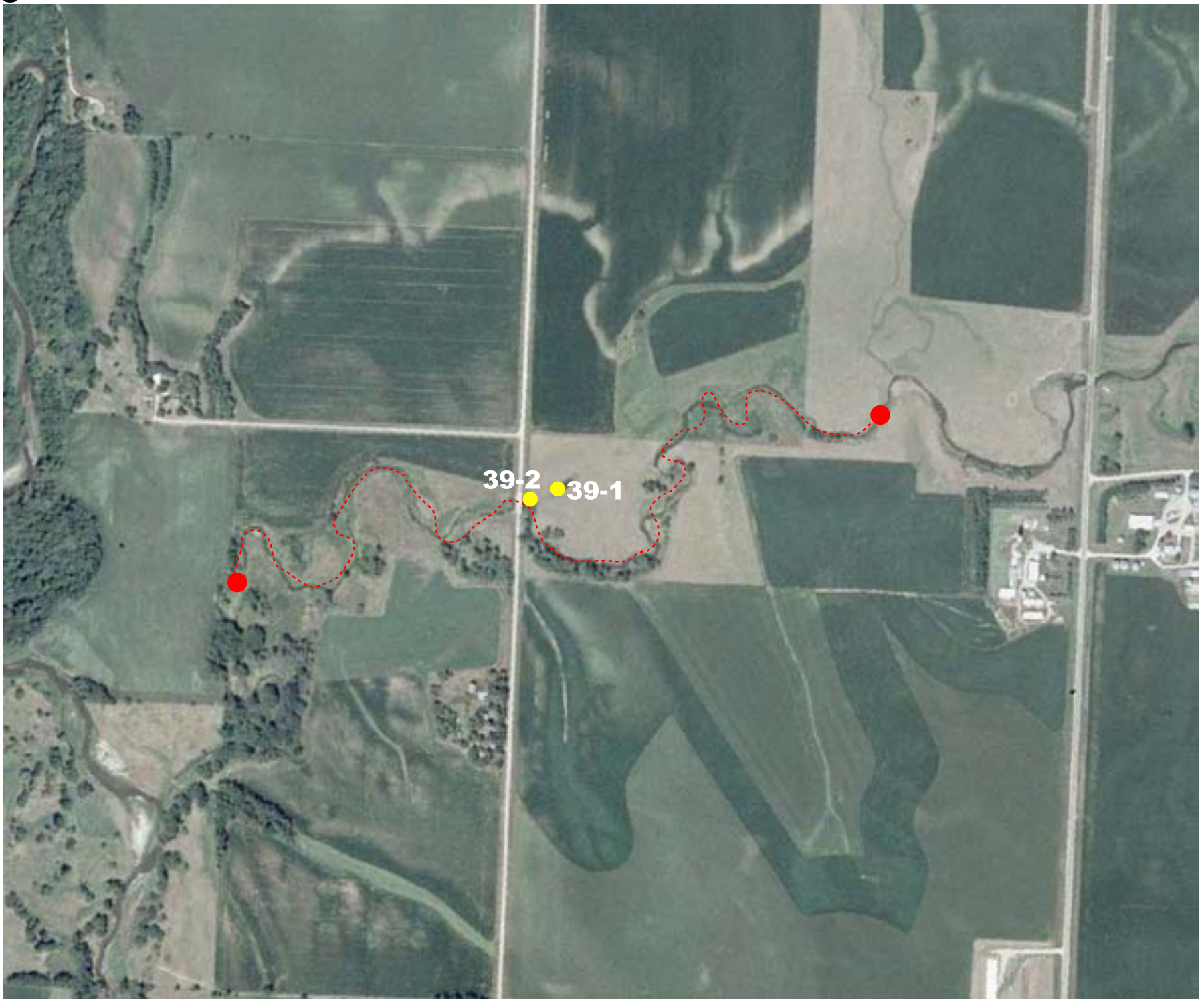
Segment 38

Rock County



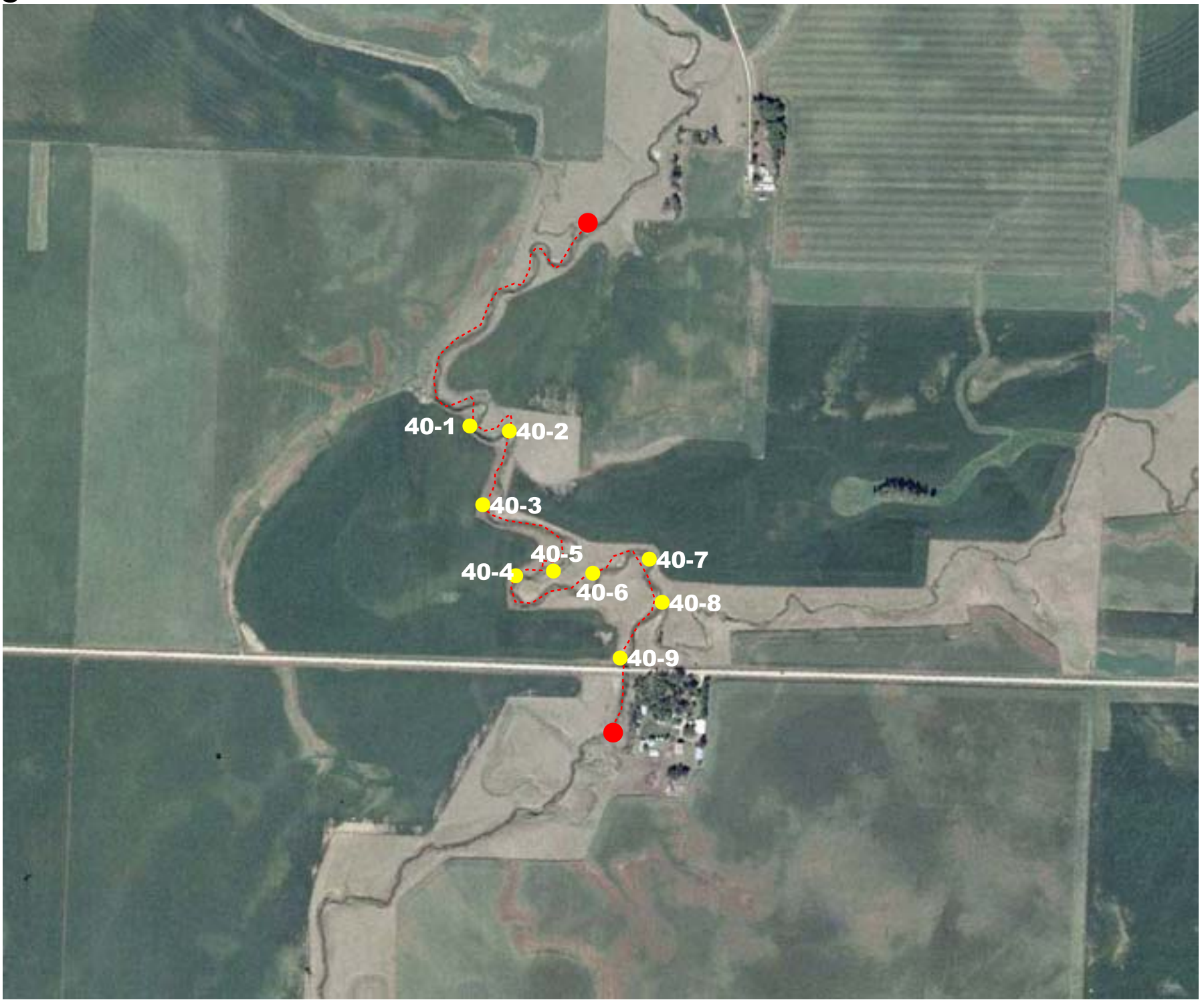
Segment 39

Rock County



Segment 40

Rock County



APPENDIX B – DESCRIPTIONS OF STREAM SEGMENTS AND SITES

Table 1 lists the twenty stream segments, and provides locality information & basic habitat descriptions of all sampling sites.

Table 1. Locations of the 2005 twenty stream Segments (sites 21-40) and corresponding sampling Sites within each Segment, along with a brief habitat description for each Site from which Topeka shiners were collected. Included are a "Common Location" descriptor (approximate mileage & direction to nearest town/highways), the Township/Range for the 20 Segments, and UTM coordinates for each sampling Site. For stream segments 22 to 24, 26 to 30, 32, and 34 to 40, the Site Number that is the highest (e.g., 38-5) is where the Topeka shiners were found. Topeka shiners were not found in Segments 21, 25, 31, 33.

Segment	Stream Name & Common Location							UTM Coordinates (Zone 15)	
	County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Northing	Easting
21	**Willow Creek** 5 mi E US 75, 0.25 mi N CR 10								
	Pipestone	108	46	17	Altona	21-1	in-channel	4895215.63385778	228473.66038496
						21-2	off-channel	4895091.68203443	228443.31906950
						21-3	in-channel	4895025.90977982	228286.88797918
						21-4	in-channel	4895036.41036340	228251.50944475
						21-5	in-channel	4895152.69948115	227977.50975805
						21-6	off-channel	4895171.69258697	227820.03955878
						21-7	in-channel	4895189.90205271	227779.42912499
						21-8	in-channel	4895179.52585185	227740.40633498
						21-9	in-channel	4895209.06134604	227717.49454505
						21-10	in-channel	4895200.11358622	227655.86272095
	A very small, flowing headwater creek (≤ 5 foot width), with a large pool above & below the bridge and a few main-channel flowing pools, but typical topeka pools were absent. Thick filamentous algae throughout. Two OCH (cow ponds) also sampled. Substrate = deep "muck" with a few stretches of firmer mud/sand.								
22	**North Branch Pipestone Creek** 1/2 mi S Cazenovia @ CR 53								
	Pipestone	107	46	21, 22	Troy	22-1	in-channel	4884166.31662091	230228.60342916
	Relatively stable stream banks with well-rooted grasses along the banks and immediate floodplain; clear water. Topekas caught in first seine haul. Substrate = clean gravel and sand.								

Table 1. Continued.

Segment	Stream Name & Common Location							UTM Coordinates (Zone 15)	
	County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Northing	Easting
23	**North Branch Pipestone Creek** 1.5 mi SW Cazenovia @ CR 53								
	Pipestone	107	46	20,21,28,29	Troy	23-1	in-channel	4882980.82516184	228588.80960851
						23-2	in-channel	4883308.36080703	228618.56859384
	Relatively stable stream banks with well-rooted grasses along the banks and immediate floodplain; clear water; numerous backwater pools that are relatively shallow & wide. Light cattle grazing & wading, but the sandy/gravel soil seems to withstand the impact fairly well. Topekas caught in first seine haul @ 23-2. Substrate = clean gravel and sand.								
24	**Pipestone Creek** Pipestone State WMA @ outflow of Indian Lake								
	Pipestone	106	46	2	Sweet	24-1	in-channel	4879803.51246957	233172.48384674
	Well-rooted grasses along the banks and immediate floodplain; many backwaters downstream of spillway. Topekas caught in second seine haul. Substrate = sand, gravle, and cobble.								
25	**Rock River** 2.5 mi SSE Holland								
	Pipestone	107	44	19	Rock	25-1	off-channel	4883405.78510540	245960.26136561
						25-2	in-channel	4883610.08091577	245921.59384372
						25-3	in-channel	4883589.97655839	245894.32169142
						25-4	in-channel	4883513.95668240	245937.17266257
						25-5	in-channel	4883494.95761799	245962.23857102
						25-6	in-channel	4883355.41345563	245850.99589289
						25-7	in-channel	4883270.56802341	245950.81444504
						25-8	in-channel	4883127.69866543	246007.88942490
						25-9	in-channel	4883096.30361624	245956.35048190
						25-10	in-channel	4883051.71280960	246018.40952210
	Narrow, downcut, flowing channel. No pools. OCH farm pond contains large numbers of breeding fathead minnows. Substrate = 6-12" of silt covers the sandy substrate.								

Table 1. Continued.

Segment	Stream Name & Common Location							UTM Coordinates (Zone 15)	
	County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Northing	Easting
26	**East Branch Rock River** 2 mi NNW Woodstock @ CR 6								
	Pipestone	107	44	27, 34	Rock	26-1	in-channel	4880699.76601451	250314.86007706
	Small stream (5' ave. width) that is expanded into a large pool around the bridge crossing. Topekas caught in second seine haul. Substrate = deep "muck" in pool except for the area immediately upstream of the pool outflow (where the Topekas were found).								
27	**East Branch Rock River** 2 mi W Woodstock								
	Pipestone	106	44	5	Burke	27-1	in-channel	4878404.71434312	247488.90314799
	A series of well-developed long pools broken by riffles & flowing runs; pools with shallow sections that are suitable Topeka habitat. Stream banks in pasture but no signs of recent cattle grazing or wading. Topekas caught in first seine haul. Substrate = sand/gravel mixture.								
28	**East Branch Rock River** 3 mi SW Woodstock; 0.25 mi S Hwy 30								
	Pipestone	106	44	8, 17, 18	Burke	28-1	in-channel	4875764.92261046	246400.01424548
						28-2	in-channel	4875785.50081009	246399.51100740
						28-3	in-channel	4875798.66627389	246398.27999922
	Numerous backwaters; stream banks in pasture but no signs of recent cattle grazing or wading. Substrate = sand/gravel mixture.								
29	**Split Rock Creek** 1 mi W Hwy 23; 5 mi N Hwy 14								
	Rock	104	47	1	Rosedell	29-1	in-channel	4859165.13125005	225398.49291554
	Stream width averages 10' but 29-1 is a long, wide pool with backwater created by sand/gravel bar. Light cattle grazing & stream wading but the sandy/gravel soil seems to withstand the impact fairly well. Topekas caught in first seine haul. Substrate = sand/silt/gravel mixture.								
30	**Poplar Creek** ca. 2 mi SW Edgertown; 0.5 mi W CR 1								
	Pipestone	105	44	32	Osborne	30-1	in-channel	4860193.75625141	246194.87617336
	Shallow relatively wide (25') pool. Numerous pools/backwaters present in this segment; banks stabilized by grasses; no recent evidence of cattle grazing or wading. Topekas caught in first seine haul. Substrate = relatively clean gravel & sand.								

Table 1. Continued.

Segment	Stream Name & Common Location							UTM Coordinates (Zone 15)	
	County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Northing	Easting
31	**Champepadan Creek** ca. 4 mi N Lismore @ Chaney Ave; 1.2 mi N Hwy 18								
	Nobles	104	43	14	Leota	31-1	in-channel	4854710.44435886	260882.05268653
						31-2	in-channel	4854727.30080799	260904.02569335
						31-3	in-channel	4854720.36777091	260982.28338447
						31-4	in-channel	4854722.31098581	260999.29766236
						31-5	in-channel	4854727.60088766	261079.61493282
						31-6	in-channel	4854725.32625166	261134.37100491
						31-7	in-channel	4854734.82333261	261320.86233098
						31-8	in-channel	4854730.37251939	261351.11511407
						31-9	in-channel	4854766.93648497	261458.87482979
						31-10	in-channel	4854777.20684475	261496.62294597
	Small headwater (ave width ≤ 5 ft); primarily flowing water throughout. Substrate = sandy/silt.								
32	**Champepadan Creek** ca. 5 mi NW Lismore; between Birkett & Ahlers Avenues								
	Nobles	104	43	29	Leota	32-1	in-channel	4852629.11965215	256204.95958202
	Meandering "bottom-land" stream; bank-full from heavy rains, but Topekas caught in backwater on 3rd seine haul. Cattle grazing and wading appear light. Substrate = firm sand-silt mixture								

Table 1. Continued.

Segment	Stream Name & Common Location							UTM Coordinates (Zone 15)	
	County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Northing	Easting
33	**Mound Creek** ca. 4 mi NE Luverne; 1 mi SE intersection Hwys 8 & 19								
	Rock	103	44	19, 30	Vienna	33-1	in-channel	4843721.03215372	245457.47076076
						33-2	in-channel	4843735.72636334	245445.49742432
						33-3	in-channel	4843747.79106353	245438.39552236
						33-4	in-channel	4843840.76911126	245378.32822264
						33-5	in-channel	4843823.96733318	245378.36431997
						33-6	in-channel	4843806.00156611	245381.53379370
						33-7	in-channel	4843799.03634034	245364.94023310
						33-8	in-channel	4843804.34710951	245349.64693926
						33-9	in-channel	4843780.03418677	244756.88933383
						33-10	in-channel	4843795.52836164	244733.54492277
	Could not sample the lowest 1/3 of this segment since it was inundated by the rain-swollen Rock River. This is a narrow (average width 5'), downcut, fast-flowing headwater. Many fishes and species present, but not good Topeka habitat. Substrate = sand & gravel.								
34	**Elk Creek** 1.5 6 mi SW Lismore @ 210th St								
	Nobles	103	43	29, 32	Lismore	34-1	in-channel	4841703.55416343	256595.57163357
	Essentially a narrow ditch segment, but Topekas caught in first seine haul in a backwater by the culvert that led to the old channel. Substrate = sand-silt mixture.								
35	**Kanaranzi Creek** 1.5 mi NNE Adrian (same site as 7-1 from 2004 survey)								
	Nobles	102	42	6, 7	Olney	35-1	off-channel	4838158.54756525	264685.89688097
	This is a large oxbow that was connected to the main channel; it appears that the oxbow loses the connection as the water levels recede during the summer. Even with high waters from heavy rains, Topekas caught in first seine haul. Substrate = relatively firm sand-mud combination.								

Table 1. Continued.

Segment	Stream Name & Common Location							UTM Coordinates (Zone 15)	
	County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Northing	Easting
36	**Kanaranzi Creek** 4.5 mi SE Adrian @ Hwy 19								
	Nobles	102	43	28, 29	Westside	36-1	in-channel	4833116.12861766	256789.07704883
						36-2	in-channel	4833104.46272189	256760.70762029
						36-3	in-channel	4832991.25280576	256361.80279831
	Numerous backwater pools that appear to be permanantly connected to the main channel. No evidence of recent cattle incursions. Substrate = relatively firm sand & silt.								
37	**Kanaranzi Creek** 1.5 mi E Kanaranzi @ Hwy 15								
	Rock	101	44	1, 12	Kanaranzi	37-1	in-channel	4829021.62992796	252566.93684001
	Numerous backwater pools that appear to be permanantly connected to the main channel. Cattle present upstream in pastures. Topekas caught in first seine haul. Substrate = firm silt and sand.								
38	**Elk Creek** 3 mi SW Magnolia; 1 mi E CR 55								
	Rock	102	44	21, 22	Magnolia	38-1	in-channel	4834516.89992934	248804.28136554
						38-2	in-channel	4834513.36738924	248782.40824716
						38-3	in-channel	4834577.25888150	248678.00043219
						38-4	in-channel	4834689.25721524	248638.68479453
						38-5	in-channel	4834692.15741523	248488.00860772
	Shallow meandering stream; 25' ave width. Substrate = sand/silt mixture in main channel; deep "muck" at cattle crossings.								
39	**Elk Creek** 0.5 mi upstream confluence with Rock River								
	Rock	102	45	25, 36	Luverne	39-1	in-channel	4832477.68047079	243149.98348329
						39-2	in-channel	4832462.99120671	243111.20005582
	High water from heavy rains; sampled a flooded mudbank backwater. OCH farm pond contains large numbers of fathead minnows and black bullheads. Substrate = mud/sand.								

Table 1. Concluded.

Segment	Stream Name & Common Location							UTM Coordinates (Zone 15)	
	County	T	R	Section(s)	Township Name	Site Number	Habitat Type	Northing	Easting
40	**Beaver Creek** 2.5 mi ESE Rushmore								
	Rock	102	46	11, 12	Beaver Creek	40-1	in-channel	4838210.17408599	232664.66105166
						40-2	in-channel	4838202.08981847	232726.91481538
						40-3	in-channel	4838084.82846994	232684.80479229
						40-4	in-channel	4837972.54998508	232737.29576971
						40-5	in-channel	4837980.14591636	232796.67793258
						40-6	in-channel	4837976.35362321	232859.13278180
						40-7	in-channel	4837998.69286932	232948.63288714
						40-8	in-channel	4837930.17897683	232968.86455064
						40-9	in-channel	4837842.02063575	232902.63596425

Extensive downcutting & bank erosion (soils are deeper here than in most other segments); essentially a flowing channel throughout.
One Topeka male found next to bridge
Substrate = sand/silt mixture.

APPENDIX C –PHOTOGRAPHS OF HABITATS & FISHES

Pictures for Segments 21, 25, 31, and 33 (no Topeka shiners captured) are photos of representative stream habitat for the 1-mile stream segments. Photos for the remaining segments are of the actual stream sites where Topeka shiners were collected. The yellow outlined areas on these photos represent the exact location where the shiners were captured.

Voucher photographs of at least one fish specimen are included. Photos by P. Ceas, with the exception of the middle photo for 38-5, which was taken by Y. Monstad.

Site 21 - no topekas

Site 22-1 (in this and all following photos the area of capture is outlined in yellow)

Site 23-2

Site 24-1

Site 25 - no topekas

Site 26-1

Site 27-1

Site 28-3

Site 29-1

Site 30-1

Site 31- no topekas

Site 32-1

Site 33 - no topekas

Site 34-1 (person in photo is 2nd author)

Site 35-1

Site 36-3

Site 37-1

Site 38-5 (person in middle photo is1st author)

Site 39-2

Site 40-9